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ABSTRACT

Developments in computer technology have altered the teaching and learning process, particularly in areas of teacher preparation. Teacher education, perhaps more than any other academic discipline, utilizes the application of computer technology in human resources for both the actions of teaching and learning content and the actions of preparing others to use technology. The California State University System (CSU) has responded to the need for technologically enhanced learning by establishing specific behavior/knowledge standards for teacher education candidates. San Jose State University (SJSU) is one of the leading institutions to coordinate an institutional response to the need for technology-assisted training of teachers as well as the training of teachers to use technology. The current research is an exploration of technology apprehension among pre-service teachers at SJSU and how they learned technology in formal classroom settings. Drawing on personal narratives and a structured longitudinal survey, data revealed a loosely woven, interactive relationship-based learning environment, particularly for those with high levels of reticence toward technology. (Contains 18 references.) (Author)

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Confronting Difficulties Associated with Pre-Service Teacher Preparation Technology Apprehension: A Case Study

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Abstract

Developments in computer technology have altered the teaching and learning process, particularly in areas of teacher preparation. Teacher education, perhaps more than any other academic discipline, utilizes the application of computer technology in human resources for both the actions of teaching and learning content and the actions of preparing others to use technology. The California State University System (CSU) has responded to the need for technologically enhanced learning by establishing specific behavior/knowledge standards for teacher education candidates. San Jose State University (SJSU) is one of the leading institutions to coordinate an institutional response to the need for technology-assisted training of teachers as well as the training of teachers to use technology. The current research was an exploration of technology apprehension among pre-service teachers at SJSU and how they learned technology in formal classroom settings. Drawing on personal narratives and a structured longitudinal survey, data revealed a loosely woven, interactive relationship-based learning environment, particularly for those with high levels of reticence toward technology.

The foundations of teaching and learning are often based on an individual's abilities and experiences to receive and process information, reflecting on their value and relevance, building increasingly sophisticated concepts while simultaneously breaking down the advanced to simpler forms. Regardless of a formal definition of the process of teaching and learning, a major criterion is the communicative interaction between individuals. Communication is paramount to the teaching and learning process, particularly in grade levels where a structure of thinking is part of the learning process. A major difficulty for many is a level of reticence or fear of the communication process. Communication apprehension, also known as a dimension of "stage fright," can be a debilitating trait for both learners and teachers, and become more pronounced when the element of technology is introduced.

Technological innovations have become commonly accepted in most educational settings (Wright & Miller, 2000), particularly in teacher preparation programs. The use of technology is seen as a vehicle for the improvement of the teaching process, a tool that can promote individualized instruction, and a means for expanding the exposure of learners to many different cultures, ideas, and locations (Kulik, Kulik, & Cohen, 1980; Tapscott, 1996). Technology, when used effectively, can make learning "fun" for students while stimulating increased time on task and skill mastery. Students find that technologically adapted curriculum can offer some of the instant feedback and stimulation found in entertainment and other media, creating a more seamless environment from home, entertainment, and formal education.

The literature base on technologically-enhanced teaching consistently suggests that there is little difference among learning achievement for students enrolled in traditional and technologically-mediated instruction (Wright, 1999). Some research has suggested that moderate exposure to technology during instruction can enhance student learning. The National Council for Accreditation of Teacher Education (1999) noted that "teachers need to understand the deep impact technology is having on society as a whole: how technology has changed the nature of work, of communications, and our understanding of the development of knowledge" (p. 3).

Accepting the notion that a foundational knowledge of computer and technology abilities and applications is vital to the effective preparation of teachers, the State of California issued a mandate that all pre-service teachers demonstrate a certain level of technological competence prior to their certification as a teacher within the State. The result has been the development of courses and tests that reflect this knowledge and competence. The current study was subsequently designed to examine the apprehension

of pre-service teachers when they are initially exposed to technology as an instructional tool, and the internal and external processes they utilize to handle this apprehension.

Utilizing a case study institution, San Jose State University in California, USA, one specific teacher preparation class was included in the study. The course enrolled a diverse student body that reflected the institution's minority-majority demographic and data collection took place in the spring 2000 academic semester. Although a case study, the methods and findings related to how pre-service teachers coped and managed their technology apprehension are important to all institutions and educators who advocate and make use of different technologies to enhance teacher preparation.

Background of the Study

To best understand the difficulties that pre-service teachers have in dealing with technology, it is important explore both the general concepts of apprehension and teacher training. Apprehension has multiple layers, including reticence in both oral and written communication, and the impact that these fears can have on an individual's life choices. Teacher training also has multiple dimensions, namely the impact that state legislatures can have on individual college curriculum.

Apprehension

Communication Apprehension (CA) was initially conceptualized as the notion of stage fright (Clevenger, 1955; Curry, 1961), and has been studied primarily in areas of communication studies, and Phillips (1968) early work defined reticence as something beyond single situations and as more of a personal trait. CA has been defined as " an anxiety syndrome associated with either real or anticipated communication with another person" (p. 78). High levels of oral communication apprehension have been related to career choice, academic achievement, societal interaction, and job performance (McCroskey & Richmond, 1976; Connor & Williams, 1987). Those identified with high levels of apprehension have demonstrated less satisfaction with their college experience and are more likely to select an occupation that requires little interaction. McCroskey and Daly (1976) found in school settings that high communicative apprehensives have more negative expectations placed on them by teachers. These high CA students have been identified as less likely to participate in class discussions (McCroskey, Hamilton, & Weiner, 1974), earning overall been lower grade point averages (McCroskey & Daly, 1976), and interact with teachers less often and are less likely to ask for help (McCroskey & Sheahan, 1978).

Writing apprehension has a moderate correlation with communication apprehension, indicating that an individual may have higher comfort levels with one form

of communication, for example dyadic oral communication, while having higher levels of writing apprehension (McCroskey & Richmond, 1989). Writing apprehension has been defined as a fear or anxiety associated with writing (Daly & McCroskey, 1975), and those with high levels of writing apprehension "will be troubled about many kinds of writing and are likely to avoid writing in most situations when they can" (McCroskey & Richmond, 1989, p. 38).

The discussion of these two types of apprehensions alludes to the idea of a third type of apprehension: technology apprehension. Identified in concept in a number of studies, technology apprehension would be defined as a fear or anxiety associated with situations that require an interaction with some form of technology. Characteristics might include: avoidance of technologically-mediated services (ATM machines, self-ordering restaurants), fear of 'breaking' a computer, preferences toward oral communication, impacting career and academic major selection, and increasingly, could be seen as a variable that could negatively impact academic achievement. Technology has become embedded in the academe and the entire education industry, and the result is a segment of the population that could be seen as a 'technological backlash.'

Technology in Teacher-Training

Technology in teacher training has changed dramatically over the last 25 years. In the 1970s, a basic technology course at the typical teacher training institute in the United States focused on audio-visual technology and media production, such as producing slide shows, films, overhead transparencies, ditto sheets, and puppet shows; designing bulletin boards and learning centers; developing white, black and felt board skills; and using overhead projectors effectively. In the early 1980s, technology in teacher training focused on the in-service teacher and meant learning the fundamentals of computers (the parts of a computer and computer terminology) and programming languages, usually BASIC or Logo, in order to program Apple II, Commodore 64, TRS 80 and IBM personal computers.

In the late 1980s, technology courses began to include both pre- and in-service teacher training. These courses emphasized technologies that supplemented other instructional materials, such as interactive laser video discs and CAI (Computer Assisted Instruction) software, as well as introducing teachers to applications which they would then teach their students, such as Apple Works, an integrated software package with a word processing, database and spreadsheet. In the early to mid-1990s, technology training included learning more sophisticated application programs, such as Microsoft Works; instructional uses of PrintShop, a user-friendly graphics program; and the fundamentals of email. Teachers also evaluated CAI titles and created lesson plans based

on selected software. More advanced teacher training institutions also showed teachers how to access the Internet using Mosaic. From the mid-1990s until present, technology training for teachers grew to also include multimedia, newsletter creation, mail merge, desktop presentations using PowerPoint, use of the scanner and digital camera, NetScape or Explorer, instructional applications of the Internet, and simple web page development.

The student evaluation criteria applied in basic pre-service technology courses also changed and evolved from the traditional "mid-term and final exam" to the current electronic/print portfolio and poster session approach. The portfolio is a showcase of student teachers' computer competencies in action. Typically, student teachers will include such work as newsletters, multimedia projects, desktop presentation slides/handouts, spreadsheets, database analysis, and handouts demonstrating the effective use of graphics. Poster sessions require that student teachers choose a current technology of personal interest, such as the digital video camera; research the topic; examine the advantages and disadvantages when using the technology to enhance student learning; create effective and engaging instructional activities using this particular technology; attractively display their findings on a poster board; and finally present their findings to an entire class.

The continuous change and increasing complexity in the content of technology in teacher training courses and in student assessment in these courses is evident. The constant and rapid changes in technology create an on-going and often frustrating challenge for the faculty who teach technology courses and must fit them into the one quarter or one semester format. Many students end up feeling overwhelmed or frustrated because of the intensive and demanding curricula.

The anxiety or lack of confidence that teachers often display towards computers and other new technologies is a subject that should be of prime importance to teacher educators (Wang, 2000). Many teachers feel ill prepared and resist the integration of computers and other technologies into their instruction. Furthermore, they feel challenged and embarrassed when their students demonstrate more confidence and a more sophisticated computer skill than they do (Stone, 1998).

Since 1976, there has been a growing body of literature on the subject of teachers' attitudes toward computers. Many of these studies note that teacher educators and teacher preparation programs could play a vital role in helping teachers become less anxious and more confident computer users (Pina & Harris, 1993).

California Commission on Teacher Credentials Standards

The California Commission on Teacher Credentialling (CTC) accepted state legislation AB 1023, also known as the Mazzoni Bill (Chapter 404, Statues of 1997) outlining technology competencies for all pre-service teachers in California state universities. Upon the CTC issuance of rules and regulations related to the Mazzoni Bill, each campus of the California State University System was required to submit a plan demonstrating pre-service teacher competence levels.

Research Procedures

The Case Setting

San Jose State University was founded in 1857 as the first public university on the USA's western coast. With a current enrollment of 27,000 students, the university is divided into eight academic colleges, including the 1,600 student College of Education. The College of Education has four academic departments, 85 full-time tenured/tenure-track faculty, and an average class size of 25 students. The College offers a comprehensive teacher training program in both single and multiple subject areas, as well child development and a counseling credential, and is accredited by both the State of California and the National Council on Accreditation for Teacher Education.

To complete one of the College's teacher certificate programs, the candidate must pass a thorough hands-on test about technology. The test, offered monthly, focuses on general technology knowledge and application, and was designed to help the College comply with state-mandated guidelines on teacher competence in technology. If a candidate fails the written test enrollment in a foundations of technology course is required. This foundations course was selected for the current study.

Data Collection

Data collection took place in the spring academic semester of 2000. Students who did not initially pass the SJSU technology competence test were required to enroll in EDIT 122 Microcomputers in Education. The data collection activities occurred during the beginning (student reflective journal) and the second half of the semester when they asked to respond to a series of questions (see Table 1) four times reflecting on their experiences, attitudes, and coping mechanisms. Students were instructed that there were no "right or wrong answers, only impressions, attitudes, and perceptions you (students) may have about working with and learning to use technology." To triangulate the raw data, student reflective journals were then used to verify thematic findings after the completion of the academic semester.

Findings

Student Apprehensions and Fears

Students felt a range of emotions when learning to use computer technology for both their own use and for their future as teachers. Many students reported during the last month of the academic semester that they still felt apprehension about "not having sufficient computer skills" and that their "future students [will] knowing more than [they] do." Five of the ten students participating in this portion of the data collection reported a lack of confidence, and seven of the ten noted that the advances in technology created feelings of apprehension. One student wrote in her journal: "when I was on the road from 7th Street exit to the garage (for my final) for about 30 minutes I felt like crying. Everyone in the class looks to be very confident with using computers – It's likely to be that I'm the only one who has little knowledge." Another student wrote: "Today's class was really cool. I have always wanted to know how to use power point and now I do. Its actually really easy. I learned how to do animation. Unfortunately, I missed a week, and its been very difficult getting caught up because technology moves so fast." "I felt overwhelmed by the computer and I didn't even see how to do everything. Hopefully it will make more sense next week."

Student comments from the second through fourth weeks were consistent in reporting themes of apprehension related to the pace of technology updates, uneasiness about others being more knowledgeable about technology, and a consistent fear of "loosing" work done on the computer. Few comments were directed at the process of teaching technology use, although a student did note: "I am afraid of my students knowing more than me, but I am also afraid of getting frustrated and not using technology. For me there is an emotional factor; I think I lack of confidence about using technology effectively, and besides my school work, I don't have many chances of using a computer."

Also identified were specific concerns about technology, expressing a notion that incomprehensive knowledge leads to frustration. This finding is consistent with first-year teacher apprehensions about subject matter competency. Student comments related to technology included: "I feel angry and frustrated about trying to use some of the tools we learn in class...I feel like we need more immediate feedback and I can't imagine how I'll ever include this in my teaching," and "I can see myself teaching social studies and history, but there's no way I can see myself doing any of this [technology application] in class!"

Learning Barriers

Students experienced and reported a range of difficulties in learning to work with technology as a possible teaching tool. Many students reported feeling that their own perceptions, and understanding were substantial barriers to learning how to use technology. Comments related to possible barriers were tied closely to home life (such as "I can use the computer in class, but since we don't have one at home I don't ever use it unless I really have to") to work environments ("our school has a computer lab and that's it, I don't know how I will ever use these [computer programs] unless I buy my own PC." The most substantial barrier identified by participants, though, was the psychological frustration of technology.

In addition to comments about rapidly changing technological abilities, comments related to how technology works and a fear of "breaking" technology prevented some students working harder or embracing technology. One student wrote "I understand the software and how to work programs, but I just don't get the 1's and 0's stuff that we started with. I hope I never have to open one of these things...my computer 'froze up' and it really made me angry." Another student commented "I just don't get how to change some of the se[illegible]gs and this stuff about how information moves on the Internet is interesting but it d[illegible]t make any real sense to me...I'll use technology for visual aids and for assign[illegible]ework, but I can't imagine using it for presentations in class."

The psychology of technology also impacted student use and practice with computers. A student wrote "technology scares me," and another noted "I just can't stand it [using computers] especially when it doesn't work right – I don't want to use it if its sporadic and illogical!" A third student commented on the support from technology lab personnel, writing in her journal "I go to the lab for support not to feel stupid! The guy in there [lab technician] makes me want to never use a computer again."

Coping Mechanisms

Students reported a number of apprehensions about dealing with computing technology and various problems associated with software use, and to cope or deal with these apprehensions, they identified a number of support structures. The most frequently identified supporting mechanism to deal with apprehensions was some component of a family. Several students identified support from a husband or wife, and one student even identified his daughter as someone who knows a great deal about technology and was able to provide support and tutoring on how to use technology.

Respondents did not devote a major amount of time or space in their journals or in response to the questions prompts about dealing with stress or apprehension, but

frequently made minor references to these supporting mechanisms: computer lab technicians, practicing and study computer use with friends, in-class support for learning problems, and frequently, practice. A student wrote "I've found that the best way for me to compensate for not understanding any of this is just practicing in the computer lab. The guy in there is very helpful." Similarly, a female student wrote in her journal "I guess the biggest help to me, for learning about computers and for learning how to teach with computers, has been asking the teacher for additional help and getting questions ready for that help-time."

Specific Technology Challenges

Students were asked specifically to identify their self-perceived rationale for apprehension about technology. No specific prompts were provided for students, and they were entirely open to report on what they perceived to be the reason for their fear. Seven students (of ten in the class) identified particular software and hardware as obstacles to their learning and a reason for their apprehension. Use of Excel was identified by one respondent, four students reported a fear of the Internet, and two students identified the fragile nature of the computer as something that makes them nervous in working with technology.

Not all students expressed specific apprehension about technology, as frequently students noted in their journals that were uneasy about learning new technological applications primarily because they were unfamiliar with the tools within the programs that make them easier to use. There were frequent statements made about saving or loosing materials ("I can't stand SPSS for PCs because they don't tell you how to save stratified data!" and "every time I try to down load things from the internet, I loose them. I can't afford to waste time doing this!"), and students expressed frustration in the form of either quitting, developing more apprehension, or a combination of items. A female student reported that she "cried really hard" as she attempted to learn about how to use animation in power point presentations, and a male student wrote in his journal "I tried, I really did, to get the assignment done, but the computer kept freezing and I finally just quite. You can fail me if you want, but it just doesn't work."

Other important findings including students recognizing the importance of scheduling regular computer practice outside of class and taking an introductory computer course to be exposed to different applications of computer software.

Regarding barriers, three students consistently listed their lack of access to computers and software at home as a major obstacle that prevents them from becoming

more familiar and comfortable with technology. This point was validated by another question in the survey, "Is there anything in your personal life that enables you to work more comfortably with technology? If so, what and how?" Three students attributed owning a home computer to feeling comfortable with technology because they could practice their computer skills in a low-pressure environment. In addition, four students consistently pointed out they fear being the student with the least computer knowledge. As a result, they are afraid of asking questions during class.

Discussion

Teacher training has never been more important. As the demand for well-qualified, life-long learning teachers increases in the United States, extreme pressure is placed on the agencies and bodies that provide training. In the State of California, where the need for elementary and secondary teachers is the greatest in the nation, the legislature has mandated a curricular content change: the addition of minimum technological competencies. San Jose State University, a member of the 23 campus California State University System interpreted this mandate through the implementation of a competency test of technological knowledge required of pre-service teachers. The technology levels identified in the test were foundational, as additional uses of technology for instructional purposes have been infused into the existing teacher preparation program.

Through the examination of one class that did not pass the test and who subsequently enrolled in a remediation course, Educational Instructional Technology (EDIT) 122 Microcomputers in Education, students were identified as having real levels of apprehension about learning and using technology. This apprehension, while assumed to be primarily state rather than trait oriented, was debilitating in some instances, inciting some students to drop out of the course, others to experience emotional distress, and still others rising to the challenge of conquering their fears. Similar to communication and writing apprehension, technology apprehension could be considered part of the variance for student non-success in a competency-based test. Additionally, this reinforcement of the simple notion of technology apprehension encourages dynamic, meaningful research and experimentation in the management of apprehension. Also, there is a need to address the environment of technology integration into teacher education, as the parallels of infusion and supplementation may be problematic from the student as well as the faculty or consumer perspective.

An important finding in the case study was the high level of family-related support for learning technology. Whether a spouse or child, those who encountered and reported apprehension of technology use and learning found encouragement from those

in non-threatening roles around them. One student whose spouse was away on business during the course found herself in a state of panic and in "desperate" need of support and help. To some extent, this reliance is a positive finding, meaning these pre-service teachers have a somewhat holistic view of their educational experience, and interweave a home or personal life with the academic classroom setting.

In addition to the high level of family-related support for learning technology, other important findings are that several students attributed taking a structured introductory computer course, such as EDIT 122, to increase their comfort level with computers. This point counters the popular belief that you can pick up computer skills just by playing with the technology. Students consistently pointed out that the lack of computer and appropriate software at home is the primary obstacle for becoming familiar and comfortable with technology because they prefer to practice their computer skills at home. While a study by Laffey and Musser (1998), shows that computer anxiety statistically differs between students who own a computer and students who do not own a computer. The study did not show the absolute difference to be substantial.

Society, in general, is driven by an urgency to integrate technology in the schools. Reducing computer apprehension for pre-service teachers is a very important first step. In this case study, we learned family support, access to computers (e.g., ownership of personal computers at home), and structured introductory computer courses are important factors to reducing technology anxiety. However, as computer technology rapidly changes, teachers are continuously facing an up-hill learning curve to learn new technology, then they have to integrate the new technology in their classrooms. This pressure is compounded by the fact that many teachers are afraid that their students are more familiar with computers than they are. How to support and nurture teachers in learning new technology is a critical issue for many educators.

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Table 1

Questions for Reflective Answering by Students

Question
What is your greatest "technology-related" fear?
During the past five or six months, has your comfort level in working with technology changed? How has it changed, and why do you think it has changed?
What barriers or obstacles do you perceive to have prevented you from becoming more familiar and comfortable with technology? Please describe the nature of these barriers or obstacles.
What experiences or situations have improved your comfort level in working with technology? Describe these experiences or situations, noting whether they have anything to do with SJSU.
Is there anything in your personal life that enables you to work more comfortably with technology? If so, what and how?
What has been the hardest aspect of technology to learn during the past semester? Why do you suppose this has been hard to learn?